LOWER WILLAMETTE GROUP

PORTLAND HARBOR RI/FS

ROUND 3 SAMPLING FOR LAMPREY (*LAMPETRA* sp.) TISSUE FIELD SAMPLING REPORT

DRAFT

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This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

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Prepared for:
The Lower Willamette Group

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CAS	Columbia Analytical Services, Inc.
DGPS	differential global positioning system
EDD	electronic data deliverable
EPA	US Environmental Protection Agency
FSP	field sampling plan
ID	identification
Integral	Integral Consulting, Inc.
LWG	Lower Willamette Group
NAD83	North American Datum of 1983
NOAA	National Oceanic and Atmospheric Administration
QAPP	quality assurance project plan
QA/QC	quality assurance and quality control
RM	river mile
SDG	sample delivery group
USFWS	US Fish and Wildlife Service
Windward	Windward Environmental LLC
ww	wet weight

1.0 INTRODUCTION

This field sampling report describes the objectives and procedures for the Round 3 sampling event to collect lamprey ammocoete (*Lampetra* sp.) tissue within the Portland Harbor Superfund site (the Study Area [RM 2.0 to RM 11]) and upriver from the Study Area for laboratory chemical analysis. Determining the concentrations of selected chemicals in lamprey ammocoete tissue will assist in completing the baseline ecological risk assessment, as outlined in the *Portland Harbor Remedial Investigation/Feasibility Study Programmatic Work Plan* (Integral et al. 2004).

1.1 OBJECTIVES OF SAMPLING EFFORT

The specific objectives of the Portland Harbor Round 3 lamprey ammocoete tissue sampling effort were to:

- Obtain site-specific empirical lamprey ammocoete whole-body tissue data.
- Measure concentrations of chemicals in lamprey ammocoetes from the Study Area for use in evaluating risks from hazardous substances to out-migrating lamprey larvae.
- Determine whether lamprey ammocoetes from the Study Area have elevated concentrations of site-related contaminants compared with upstream reference areas.
- Collect incidental information on lamprey habitat preference based on catch success.

1.2 REPORT ORGANIZATION

The remaining sections of this document describe the field procedures and analysis plan for the ammocoete tissue sampling effort. Sections 2.0 and 3.0 present the ammocoete sampling program and procedures, respectively. Laboratory analyses are described in Section 4.0. Data management is described in Section 5.0, and reporting is described in Section 6.0. Cited references are listed in Section 7.0. Supporting information, including field collection and processing logbooks and completed field collection and field change request forms, are provided in Appendix A. Navigation logs that present the coordinates and collection information for each cast are presented in Appendix B.

2.0 AMMOCOETE SAMPLING PROGRAM

A total of 23 stations were sampled for lamprey ammocoetes (*Lampetra* sp.) between September 20 and October 16, 2006[1] (Figure 2-1). These included 21 sampling stations within the Study Area between River Mile (RM) 2 and RM 11 and two locations upstream of the Study Area that were added per the request of the US Environmental Protection Agency (EPA) (2006). Sampling procedures for the collection of ammocoetes followed those detailed in the field sampling plan (FSP) (Windward 2006) and are summarized in Section 3.0.

Representatives of the regulatory agencies and trustees were present throughout the sampling effort, to oversee field operations. Observers were Jennifer Peterson from the Oregon Department of Environmental Quality, Joe Goulet and Eric Blischke from EPA, Jeremy Buck and Mike Szumscki from the US Fish and Wildlife Service (USFWS), Chris Thompson from Environmental International Ltd., Jeff Zakel on behalf of the Grand Ronde Tribe, and Stan Van de Wetering on behalf of the Siletz Tribe. Mike Fodale and Dan Kochanski from USFWS (Marquette Biological Station) were present September 20 through September 27, 2006, to provide sampling equipment training and troubleshooting.

2.1 SAMPLING VESSEL

Tissue sampling was conducted on board the vessel *Ross Island Sampler "I"* provided by Benthic, LLC, of Portland, Oregon. The vessel was a 29-ft pontoon boat equipped with a 120-horsepower outboard motor. The forward deck had a hydraulic winch with which the deepwater electroshocker was deployed and retrieved. The starboard side was fitted with a collection basket into which the ammocoetes were deposited by the suction hose that was connected to the hood of the electroshocker. The covered aft deck space included a dry work area with tables and seating for completing paperwork (e.g., field forms).

2.2 NAVIGATION AND STATION POSITIONING

On-board navigation equipment was provided and operated by Integral Consulting, Inc. (Integral), during deployment and retrieval. Horizontal control was achieved using a computer-integrated, differential global positioning system (DGPS). The horizontal projection used for all sampling activities was the North American Datum of 1983 (NAD83).

[1] The in-field portion of the sampling event was conducted in 16 days, and 3 additional days were taken for sampling equipment troubleshooting and repairs and to process samples in the field laboratory. The entire sampling program occurred within the 3-to-4-week period allotted in the FSP (Windward 2006).

The navigation system on the sampling vessel consisted of a Trimble® (Pro XRS) DGPS unit that received real-time differential corrections from the continuously operating reference station at Appleton, Washington. The Trimble® DGPS antenna was secured on top of the davit to achieve the most accurate position for each sample. Positional accuracies on the order of ± 2 to 3 meters were achieved with this system. The Trimble® DGPS receiver output was displayed and recorded (in real time) using integrated navigation software (Trimble® TerraSync™ Version 2.50) on a laptop computer.

The integrated navigation system displayed the vessel's position relative to the target sampling location in plan view on the laptop screen. The screen display and numeric navigation data, including range and bearing to the target sampling location, assisted the vessel operator in approaching a station position.

For each electroshocking attempt, DGPS data logging was initiated once the deepwater electroshocker had touched the river bottom and the shock had been delivered. Each station presented in the FSP (Windward 2006) was initially sampled by distributing the casts equally throughout the station. When a cast was successful (i.e., an ammocoete was collected), subsequent casts were concentrated in close proximity until it was determined that no addition tissue could be collected at that location. The location of each cast was recorded using DGPS, and a table of those locations is presented in Appendix B. Table 2-1 presents the centroid of the sampling stations, as well as sampling dates and depths.

Table 2-1. Lamprey ammocoete (*Lampetra* sp.) sampling stations

Sampling Station	Location Description	RM	Sampling Coordinates[a]		Date(s) Sampled	Sampling Depth Range (ft)
			X (Easting)	Y (Northing)		
LW3-LT001	near Oregon Steel Mill	2.2	7617372	724453	9/20/06, 10/16/06	3 – 46
LW3-LT002	south bank, 0.5 mile north of Multnomah Channel	2.5	7615357	723680	9/21/06, 10/2/06	8 – 26
LW3-LT003	Multnomah Channel	3.0	7613384	720345	9/21/06	3.5 – 32
LW3-LT004	near Time Oil	3.2	7616628	719365	9/21/06	7 – 38
LW3-LT005	International Slip (Schnitzer)	3.7	7618625	717189	9/27/06	11 – 45
LW3-LT006	Slip 1, Terminal 4	4.3	7619623	714525	9/27/06, 9/28/06, 10/16/06	20 – 38
LW3-LT007	Terminal 4, upstream of Slip 3	4.8	7619701	712340	9/22/06	15 – 43
LW3-LT008	near Linnton Plywood to downstream of the Arco seawall	4.8	7618496	712260	9/21/06, 9/22/06	6 – 36
LW3-LT009	near Cathedral Park	5.7	7622056	708607	9/22/06, 10/16/06	2 – 38
LW3-LT010	US moorings embayment	6.2	7623435	706279	9/23/06, 9/24/06, 10/10/06, 10/16/06	4 – 40

Table 2-1. Lamprey ammocoete (*Lampetra* sp.) sampling stations

Sampling Station	Location Description	RM	Sampling Coordinates[a]		Date(s) Sampled	Sampling Depth Range (ft)
			X (Easting)	Y (Northing)		
LW3-LT011	Willamette Cove	6.7	7626645	705530	9/24/06	2.5 – 43.5
LW3-LT012	near the railroad bridge at Arkema	6.8	7626231	704276	9/23/06	3 – 40
LW3-LT013	Arkema dock area	7.3	7628011	702553	9/23/06, 10/10/06	4 – 32
LW3-LT014	Reidell Cove (Triangle Park)	7.4	7629353	703051	9/24/06, 10/10/06	2 – 48
LW3-LT015	mouth of Salzman Creek; McCall/upstream of Wilbridge Docks	7.7	7628979	700745	9/27/06	7 – 39
LW3-LT016	adjacent to Portland Shipyard	8.2	7632105	700631	9/25/06	4 – 57
LW3-LT017	mid-point of Swan Island Lagoon	8.5	7634683	700486	9/28/06	30 – 33
LW3-LT018	upstream of Portland Shipyard	8.8	7634394	698030	9/25/06, 9/28/06, 10/9/06, 10/10/06	10 – 40
LW3-LT019	Shaver Transportation/City of Portland outfall, adjacent to Gunderson	8.7	7632705	697384	9/28/06	6 – 34
LW3-LT020	in “fireboat cove”	9.7	7637420	694588	10/2/06	3.4 – 32.4
LW3-LT021	Goldendale Aluminum	10.0	7639821	694256	9/29/06, 10/9/06	7 – 50
LW3-LT022	upstream downtown reach	11 – 11.7	NA	NA	9/29/06	17 – 35
LW3-LT023a	Ross Island	15.5	NA	NA	10/3/06	4.3 – 15.3
LW3-LT023b	Sellwood Bridge	16.5 – 17	NA	NA	10/3/06, 10/4/06	0.1 – 18
LW3-LT023c	Elk Rock Island	18.7	NA	NA	10/4/06	2.5 – 10

[a] X and Y coordinates are the centroid of the target sampling area.

RM – river mile

NA – not available; these upstream sites were selected in the field (based on EPA recommendations) (EPA 2006) after approval of the Final FSP and thus no target centroids were available

3.0 AMMOCOETE SAMPLING PROCEDURES

This section presents the sampling and processing procedures used to collect ammocoete samples with the deepwater electroshocker. The procedures followed those detailed in the FSP for the Round 3 sampling of lamprey ammocoete tissue (Windward 2006).

3.1 AMMOCOETE SAMPLE COLLECTION

Lamprey (*Lampetra* sp.) ammocoete and macropthalmia—transitional individuals between ammocoetes and juveniles that were collected per EPA (2006) request—collection was attempted at each of the 23 sampling stations using a deepwater electroshocker that was placed on the sediment surface. The electroshocker consisted of a 0.61-m^2 electric grid connected to a pump. The grid was fitted with a non-conductive polyvinyl chloride cover, and the electric field was confined within the cover. Power was supplied by a backpack electrofishing unit. The electric field generated by the electroshocker irritated the ammocoetes and caused them to emerge from the substrate, at which time they were suctioned through a 7.6-cm-diameter hose, transported to the surface, and deposited into a collection basket on the boat. For Round 3 ammocoete sampling event, the backpack unit delivered three pulses DC per second at 10% duty, with a 2:2 pulse train (two pulses on, two pulses off). Output voltage was adjusted to produce a peak voltage gradient between 0.6 and 0.8 V/cm across the electrodes. The suction was produced by directing the flow from the pump through a hydraulic eductor so that collected ammocoetes did not pass through the pump. The sampling techniques employed were similar as those used in the Great Lakes region (Fodale et al. 2003), and they are described in detail by Bergstedt and Genovese (1994).

At each sampling location where the electroshocker was placed, suction began approximately 15 seconds prior to shocking until all air was cleared out of the suction hose. Shocking was then conducted for 30 seconds, and the suction pump remained on for an additional 15 seconds after shocking to ensure that any collected ammocoetes would clear the hose and empty into the collection basket before moving on to the next cast location. Because relatively few ammocoetes were caught throughout the Study Area and LWG was looking for ways to improve catch success, the sampling method was modified. The modification was based on Mike Fodale and Dan Kochanski's recommendation to increase the amount of area shocked by increasing the number of shocks to four shocks per cast location. The field change request form is provided in Appendix A.

The new method included four rounds of 30-second shocks at each location. After the initial 30-second shock, the electrofishing unit was turned off, and the electroshocker was raised a few feet above the sediment surface, moved several feet away, and lowered back down to the sediment surface. The electrofishing unit was then turned on for another 30 seconds. This was repeated until four shocks had been made. These

four shocks were treated as one cast (i.e., one sampling location). The method was first applied on October 4, 2006, at the upstream location (LW3-LT023c); but upon further direction from EPA and LWG and its partners, several stations where ammocoetes were caught in the Study Area were revisited for additional attempts to collect more tissue mass. The modified method was used exclusively until completion of the sampling effort on October 16, 2006. Chris Thompson, Jeff Zakel, and Stan Van de Wetering were present on October 9, 2006, to observe the modified method in practice. Table 3-1 presents the number of casts conducted and estimated lamprey biomass collected at each sampling station. Maps that present the cast locations at the sampling stations are provided as Figures 3-1a to 3-1c.

Table 3-1. Numbers of casts, lamprey (*Lampetra* sp.) ammocoetes and macropthalmia and estimated biomass by sampling station

Sampling Station	Number of Casts Attempted	Number of Shocks per Cast	Ammocoetes			Macropthalmia		
			Cast Identification Number with Lamprey Collected	No. of Lamprey Collected	Estimated Biomass (g ww)	Cast Identification Number with Lamprey Collected	No. of Lamprey Collected	Estimated Biomass (g ww)
LW3-LT001	30	1	8, 17, 20, 29	4	10.3	NA	0	0.0
	16	4	32, 35, 37, 39, 40, 44, 45, 46	11	14.3	43, 46	2	8.3
LW3-LT002	38	1	5, 6, 28, 29, 34, 36, 38	7	11.2	NA	0	0.0
LW3-LT003	30	1	NA	0	0.0	NA	0	0.0
LW3-LT004	19	1	NA	0	0.0	NA	0	0.0
LW3-LT005	30	1	NA	0	0.0	NA	0	0.0
LW3-LT006	30	1	16	1	1.3	NA	0	0.0
	10	4	NA	0	0.0	NA	0	0.0
LW3-LT007	30	1	NA	0	0.0	NA	0	0.0
LW3-LT008	30	1	NA	0	0.0	NA	0	0.0
LW3-LT009	30	1	2	1	2.5	NA	0	0.0
	20	4	39, 43	2	2.2	NA	0	0.0
LW3-LT010	30	1	19	1	0.5	NA	0	0.0
	18	4	NA	0	0.0	47	2	7.9
LW3-LT011	30	1	NA	0	0.0	NA	0	0.0
LW3-LT012	30	1	NA	0	0.0	NA	0	0.0
LW3-LT013	30	1	NA	0	0.0	NA	0	0.0
	1	4	NA	0	0.0	NA	0	0.0
LW3-LT014	30	1	NA	0	0.0	NA	0	0.0
	10	4	NA	0	0.0	NA	0	0.0
LW3-LT015	30	1	NA	0	0.0	NA	0	0.0
LW3-LT016	30	1	NA	0	0.0	NA	0	0.0
LW3-LT017	10	1	NA	0	0.0	NA	0	0.0
LW3-LT018	30	1	14, 26, 32, 36	2	5.8	NA	0	0.0
	25	4	47, 50	5	6.0	31, 55	2	8.8
LW3-LT019	30	1	NA	0	0.0	NA	0	0.0
LW3-LT020	30	1	5	1	0.2	NA	0	0.0

Table 3-1. Numbers of casts, lamprey (*Lampetra* sp.) ammocoetes and macropthalmia and estimated biomass by sampling station

Sampling Station	Number of Casts Attempted	Number of Shocks per Cast	Ammocoetes			Macropthalmia		
			Cast Identification Number with Lamprey Collected	No. of Lamprey Collected	Estimated Biomass (g ww)	Cast Identification Number with Lamprey Collected	No. of Lamprey Collected	Estimated Biomass (g ww)
LW3-LT021	30	1	2, 28	2	1.0	NA	0	0.0
	20	4	38, 39, 40, 41, 42, 44, 46, 47	14	16.5	47, 38, 37, 49	5	19.4
LW3-LT022	30	1	9, 18, 21	3	3.0	2	1	3.2
LW3-LT023a	4	1	NA	0	0.0	NA	0	0.0
LW3-LT023b	100	1	4, 5, 6, 7, 8, 10, 15, 17, 18, 23, 24, 35, 38, 43, 49, 53, 59, 64, 71, 78, 80, 85, 88, 90, 92, 94, 95, 96, 97, 98	49	33.6	NA	0	0.0
LW3-LT023c	37	4	1, 2, 4, 5, 6, 7, 9, 10, 12, 14, 15, 20, 21, 22, 23, 24, 25, 26, 27, 30, 34, 37	44	64.7	4, 9, 12, 22, 23, 27	9	29.0

NA – not applicable; no ammocoetes collected
ww – wet weight

As described in the FSP (Windward 2006), for each sampling station, multiple casts were completed until a combined total of 35 g[2] or a maximum of 30 casts was achieved, whichever came first. All lamprey collected at each sampling station were retained for chemical analysis, even if the target tissue mass was not obtained. Ammocoetes were not identified to the species level but left at genus level (*Lampetra* sp.); any macropthalmia that were collected were separated from the ammocoetes.

Table 3-1 also shows the number of lamprey collected (i.e., catch success) at each location, which indicates lamprey habitat preference. The catch results suggest that lamprey prefer the upstream locations (LW3-LT023b and LW3-LT023c) over the Study Area locations. Additional discussion and interpretation of catch results will be presented in the data summary report.

It was not possible to collect the target tissue mass (i.e., 35 g) at any of the sampling stations within the Study Area with the maximum level of effort (i.e., 30 casts). Additional casts were made at locations where lamprey collection was more successful, but overall, only 71.8 g of lamprey tissue were collected from the entire Study Area. At the sampling station upstream of the Study Area (LW3-LT023), more than 30 casts were made at each of two sub-stations (LW3-LT023b and LW3-LT023c), and these are the only sub-stations at which sufficient tissue mass was obtained (33.6 g at LW3-LT023b and 64.7 g at LW3-LT023c).

3.2 SAMPLE PROCESSING

On the sampling vessel, each ammocoete was taken out of the collection basket and wrapped in heavy-duty aluminum foil before being placed in a glass sampling jar and in a cooler with dry ice. In the field laboratory, the length and weight of each ammocoete was measured and recorded in the field logbook and on the field collection forms (Appendix A). Photos were taken of each lamprey (Appendix C), and a general description of each individual was recorded in the field logbook. Each ammocoete was re-wrapped in a new, clean piece of aluminum foil and placed in a glass sampling jar. All individuals from the same sampling station were placed in the same sample jar and stored frozen until awaiting compositing and shipment to the analytical laboratory for homogenization and analysis (Section 4.0). At the request of EPA (2006), macropthalmia were identified and counted separately from the ammocoetes but were processed in a similar manner.

[2] A total of 30 g of tissue was needed, at a minimum, to complete the full suite of analyses. However, to accommodate loss to sample container walls and homogenization equipment, a total of 35 g was targeted in the field.

3.3 EQUIPMENT DECONTAMINATION

The cover of the deepwater electroshocker and the collection basket were decontaminated with an Alconox™ solution and rinsed with site water at each sampling station prior to the initiation of sampling.

3.4 TISSUE SAMPLE IDENTIFICATION SCHEME

All samples were assigned a unique identification (ID) code, as described in Section 2.4.2 of the FSP (Windward 2006), that incorporated the project phase and sample type and was designed to meet the needs of field personnel, data management personnel, and data users. The lamprey samples will be shipped to the analytical laboratory in separate jars. The jars will be labeled with the sampling round, tissue type, and composite ID (e.g., LW3-LT-Comp1), as well as the date and time the composite was created. The final samples created in the analytical laboratory will be composited and labeled as presented in Section 4.0. The replicate lamprey tissue sample from sub-station LW3-LT023c will be created in the analytical laboratory and identified as LW3-LT-Comp4-1 or LW3-LT-Comp4-2.

3.5 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

Sufficient lamprey tissue was collected from the upstream sampling sub-station LW3-LT023c to create a replicate sample. The lamprey were not processed further in the field laboratory, so no rinsate blanks were collected at the field laboratory.

Temperature blanks will be used to measure and ensure cooler temperature during shipment to the analytical laboratory. One temperature blank will be prepared and submitted with each cooler. The temperature blank will consist of a 50-mL plastic vial containing deionized water that will be packed into the cooler in the same manner as the rest of the samples and labeled “temp blank.”

3.6 TISSUE SAMPLE HANDLING, STORAGE, AND TRANSPORTATION

The lampreys collected from each sampling station are being stored frozen in glass jars at the field laboratory, with the macropthalmia separated from ammocoetes. For shipment, the lamprey samples will be packed to prevent breakage and separated in the shipping container (cooler) by bubble wrap and/or other shock-absorbent material. Loose ice will be placed in the cooler to help keep the samples frozen. Lamprey tissue samples will be delivered to the analytical laboratories once EPA approves a tissue compositing approach, which is currently under development. Samples will be placed in the freezer at the laboratories upon receipt. After an agreement is reached with EPA and its partners about which samples to include in the composited tissue sample, the lamprey samples will be homogenized at the analytical laboratories.

3.7 CHAIN OF CUSTODY

Sample chain-of-custody procedures will follow the guidelines provided in Section 3.2.2 of the FSP (Windward 2006). The chain-of-custody form will be placed in a zip-lock bag and taped to the inside lid of each cooler. Each cooler will be sealed with shipping tape and three chain-of-custody seals, which will include the project name, date of shipment, and the name of the person sealing the cooler.

3.8 FIELD DOCUMENTATION

All field sampling activities and observations were noted in bound field logbooks (Appendix A). Information included the names of personnel, date, time, station designation, number of cast and shock attempts, number of lamprey collected, and general observations. Any changes that occurred at the site (e.g., personnel, responsibilities, deviations from the FSP) and the reasons for these changes were documented in the field logbook.

A sample chain-of-custody form will be completed in the field laboratory for each composite tissue sample before it is shipped from the field laboratory to the analytical chemical laboratory. The chain-of-custody forms for the composite tissue samples will be kept in the project file at Integral's Olympia, Washington, office.

4.0 LABORATORY ANALYSES

This section summarizes the chemical analyses to be performed on the field-collected lamprey ammocoete and macropthalmia tissue samples. The chemical analyses of all tissue samples will be performed by two laboratories. Columbia Analytical Services, Inc. (CAS), of Kelso, Washington, will composite and homogenize the tissue samples and complete analyses for phthalates and selected semivolatile organic compounds, polycyclic aromatic hydrocarbons, mercury and other metals, butyltin compounds, and percent moisture. Axys Analytical Services, Ltd., of Sidney, BC, Canada, will complete analyses of lipids, organochlorine pesticides, polychlorinated biphenyl congeners, and dioxins and furans.

The analysis of all chemicals listed in the FSP (Windward 2006) and quality assurance project plan (QAPP) (Integral and Windward 2004, 2005) required a minimum of 30 g of ammocoete tissue. Because this ammocoete mass could not be obtained at any sampling station within the Study Area and several lamprey macropthalmia were collected during the effort, a composting and analytical scheme is currently under discussion between the Lower Willamette Group (LWG) and EPA.

5.0 DATA MANAGEMENT

Once the chemical laboratories have completed their internal quality assurance and quality control (QA/QC) checks, they will submit the data in electronic format to Integral. Additional QA/QC checks will be performed at Integral; and if any problems are found in the electronic data deliverables (EDDs), the appropriate laboratory will be notified and asked to correct the problem and resubmit the EDD. When the EDD is correct and complete, the data will be checked again electronically by loading them into the temporary section of Integral's LWG project database. Any errors will prevent the EDD from loading until the error is corrected. Each EDD will be tracked until it is successfully loaded into the LWG project database.

Each verified and accurate EDD will be provided to the Round 3 data validation contractor (EcoChem of Seattle, Washington) for data review and validation. As EcoChem completes validation of the data by sample delivery group (SDG) or small groups of SDGs, the validated data will be merged into the permanent project database. During the merging process, all previously performed electronic checks will be repeated to ensure that nothing was incorrectly modified with the application of the validation results.

Several queries have been set up in the permanent project database to translate the data structure to a form that is compatible with the National Oceanic and Atmospheric Administration's (NOAA's) Query Manager. The translated data will be imported into a NOAA-provided Microsoft® Access file that contains template tables for the Query Manager structure.

6.0 REPORTING

LWG-validated analytical laboratory tissue data will be provided to EPA in an electronic format and in SedQual format within 150 days of completion of the sampling event. Tissue chemistry results will be reported in tabular format in the data summary report. These data will also be incorporated into the remedial investigation report and baseline risk assessment, which will be prepared after all sampling and analysis rounds for the project have been completed.

A tissue summary report will be developed within 90 days after tissue sampling and analysis. This report will be prepared by Windward and will include tissue analysis results as well as maps that display the chemistry results for selected analytes.

7.0 REFERENCES

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